

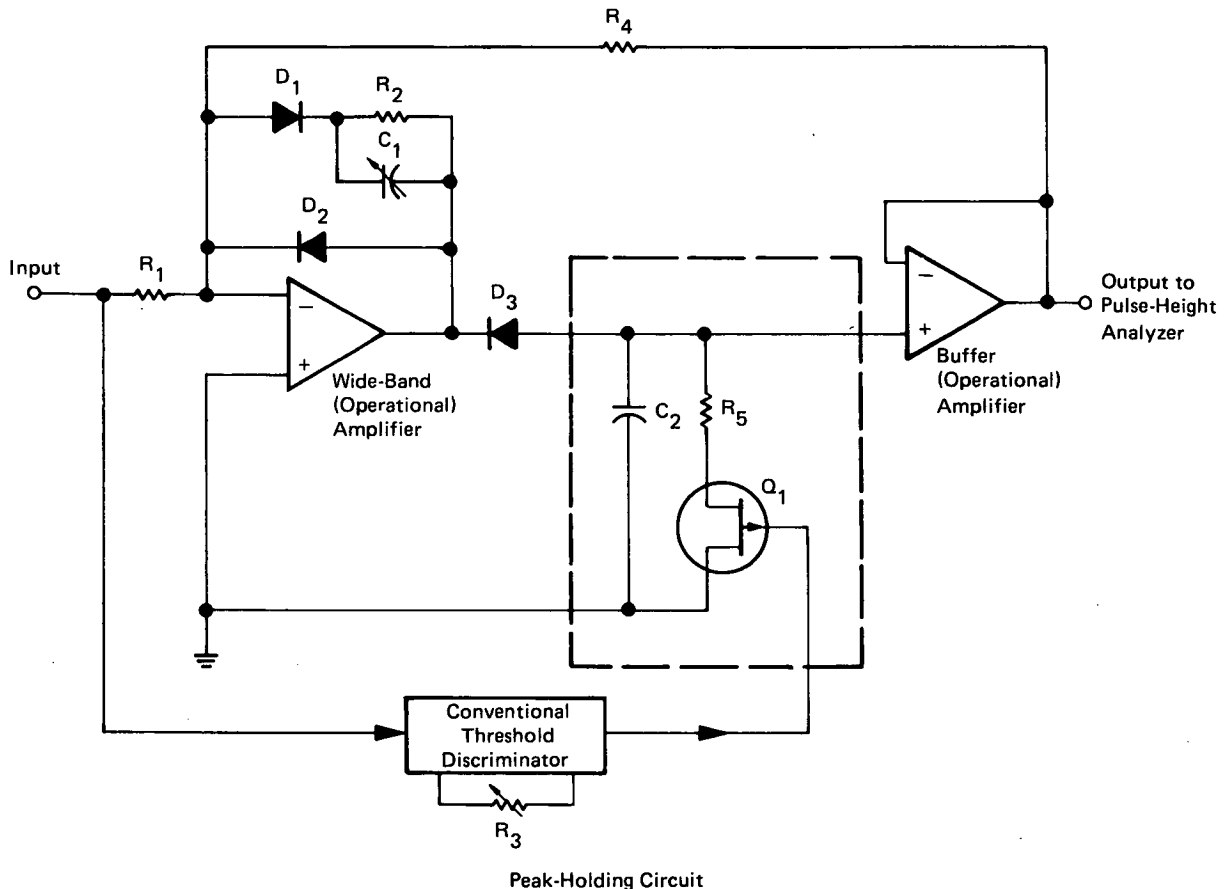
# NASA TECH BRIEF

## Lyndon B. Johnson Space Center



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### Peak-Holding Circuit for Extremely Narrow Pulses



#### The problem:

Present nuclear-pulse-height analyzers cannot analyze narrow pulse widths (50 to 3200 ns) without the aid of pulse-stretching circuits. Conventional pulse-stretching circuits, however, introduce varying frequency responses into the output signal. These responses are caused by the varying time constant of the blocking diode connecting the amplifiers on the charging capacitor. Elimination of this frequency dependence often leads to ex-

cessive frequency compensation which, in turn, reduces sensitivity of the entire circuit to very narrow pulses.

#### The solution:

A peak-holding circuit was developed which can stretch pulses in the 50- to 3200-ns range to make them acceptable for pulse-height analyzers. The circuit uses a high-speed wide-band amplifier, does not need excessive frequency compensation, and can handle pulses one-tenth of the width normally required by pulse analyzers.

(continued overleaf)

### How it's done:

The circuit (see figure), designed to operate with positive input pulses, comprises a high-speed, wide-band operational amplifier connected in a fast-charge configuration, a holding circuit, and a second operational amplifier serving as a buffer. The output of the wide-band amplifier is connected to a coupling diode,  $D_3$ , and a clamping diode,  $D_2$ . A frequency-compensating feedback network comprises a parallel combination of resistor  $R_2$  and variable capacitor  $C_1$ . Diode  $D_1$  is used to compensate for nonlinearities of  $D_3$ . The holding circuit includes capacitor  $C_2$  connected in parallel with a discharging network consisting of resistor  $R_5$  and a FET (Field-Effect Transistor) device,  $Q_1$ .

When a positive signal is fed into the input terminal, the wide-band amplifier inverts the signal, forward biases diode  $D_3$ . This allows  $C_2$  to charge to voltage proportional to the peak input-signal voltage.

The extent of pulse stretching is determined by the manual setting of variable resistor  $R_3$  in the threshold discriminator. When the input-signal pulse is stretched to proper width, the discriminator generates a "dump" pulse, turning on the FET which shorts  $C_2$  to ground through  $R_5$ . The stretched pulse is then fed through the unity-gain buffer amplifier.

The output of the buffer amplifier is also fed back to the wide-band amplifier through resistor  $R_4$ . Gain of the entire circuit is approximately equal to:

$$\frac{R_2 R_4}{(R_1) (R_2 + R_4)}$$

Normally  $R_2$  is ten times as large as  $R_4$  to reduce the effect of nonlinearities in  $D_1$  and  $D_3$ . Nonlinearities less than 0.015% are possible by choice of proper components.

### Note:

Requests for further information may be directed to:

Technology Utilization Officer  
Lyndon B. Johnson Space Center  
Code JM7  
Houston, Texas 77058  
Reference: TSP73-10317

### Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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